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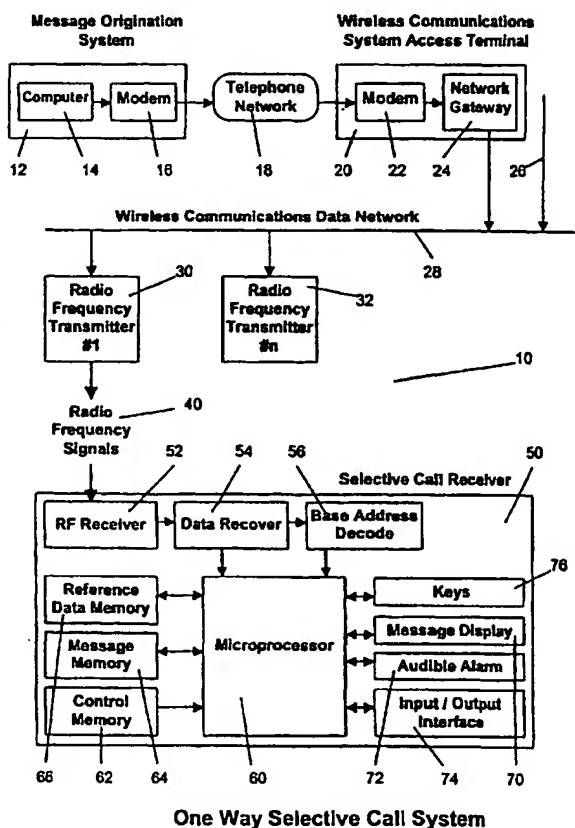
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(54) Title: EMERGENCY MESSAGING SYSTEM



(57) Abstract: An emergency notification system using selective call communications techniques is provided for communicating human and property safety information to and from recipients scattered over wide geographic areas. A computer (14) controlled head end communications interface adds subaddress information to a message to target intended recipients. A media router (24) directs the message through appropriate transport media in accordance with the address information. Preferably, the messages are communicated, at least in part, over existing paging systems.

WO 01/35361 A1



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

- 1 -

EMERGENCY MESSAGING SYSTEM**RELATED APPLICATION**

This is a Continuation-in-Part of U.S. Patent Application Serial No. 08/845,912 filed April 25, 1997, which is itself a continuation-in-part of U.S. Patent Application Serial No. 08/696,014 filed August 20, 1996.

BACKGROUND OF THE INVENTION

This invention relates generally to emergency notification systems and, more particularly, to systems for communicating human and property safety information by directing messages to people grouped by generalized descriptions of the group contained within or along with the message.

The need to communicate limited content data messages for warning and mobilization purposes in emergency situations is growing. Sirens, radio/TV emergency alert systems ("EAS"), telephone ring-down and other systems are becoming antiquated and ineffective for an array of technical, lifestyle, building construction, legal, regulatory, societal expectation and other reasons. These legacy systems are limited by dependence on AC power, vulnerability to weather and natural disasters, human errors and system delays.

Legacy warning systems are barriers to other safety technology because they are not amenable to ready conversion into digital format. Plume-cloud and other real-time computer aided modeling and graphic information systems software are important tools for combating terrorism and other disaster scenarios. To minimize human error and maximize response times, these tools must

- 2 -

interface directly and seamlessly with early-warning /
emergency information dissemination / mobilization
systems.

5 While some warning systems like EAS do preface
messages with message source, coverage area, and other
control information, this control information is not
infinitely variable. Geographic areas are fixed, large
and pre-defined. The control information is suited for
10 by news broadcast and other media rather than general
public.

Existing wireless communications of known
configuration like paging systems solve part of the
message targeting problem. Such selective call radio
15 systems combine the speed and coverage of wireless
"broadcast" techniques with the address-specific
capabilities of wire-based systems. Accordingly,
wireless paging systems can be well suited for providing
cost-effective, efficient and immediate, limited
20 communications between for example, utilities and police,
fire and disaster control authorities on the one hand,
and widely dispersed community residents on the other.

Unfortunately, existing selective call systems
are not a total solution for emergency notification.
25 Paging systems commonly use receivers that recognize a
limited number of single level address selection
(variously Code Assignment Plan (CAP), or Capture) codes.
Because of these and other technical limitations,
emergency managers have generally restricted radio paging
30 and other selective call system usage to emergency and
political personnel.

Selective call communications systems are
generally operated to be address specific, that is a
message is sent to message recipients with specific
35 addresses. In some selective call applications, the

- 3 -

message sender may not know the specific addresses of individual message recipients. In such cases, selective call communications systems are generally operated by pre-assigning specific group addresses to message recipients with common interests such as those desiring to receive stock prices or volunteer firefighter information. When grouping of message recipients is dynamic, selective call systems are generally operated to transmit auxiliary specific group addresses to each intended message recipient in advance of the informational message (Petrey et al, US Patent 5,635,914). Still another method (Mallia, US Patent 5,007,830) includes the specific addresses of intended message recipients with an informational message. Neither the method of Petrey et al nor that of Mallia is satisfactory when the grouping of message recipients is highly dynamic and involves very large numbers of message recipients. Group set-up time and/or message length become excessive and impractical. Both methods require that the message sender or selective call system operator know the specific addresses of the intended message recipients:

The prime objective of the present invention is a means of achieving dynamic grouping involving extremely large numbers of potential message recipients in a selective call system where grouping and messaging is accomplished with minimal communications traffic, in minimum time, and without knowledge of specific end-user addresses by the message sender.

SUMMARY OF THE INVENTION

The present invention provides a method of operating a wireless system so as to communicate messages to specific groups amongst a plurality of potential message recipients according to whether the potential message recipients meets arguments in one or more

- 4 -

group-identifying descriptions transmitted with or as part of a message. Identified groups may be highly dynamic and have a vast range of combinations of intended message recipients. The message sender may reach one to
5 a nearly infinite number of intended message recipients with a common message. The message sender does not know or cause transmission of the specific addresses of intended message recipients, rather only knows generalized characteristics. Examples of generalized
10 characteristics include a geographic area such as a polygon having a list of vertices as arguments, or a functional role such as firefighter having rank such as captain as an argument.

For purposes of understanding the present
15 invention, a generalized characteristic is represented by a code or code sequence known to the receiver as being indicative of a category is called a token. Code or code sequences generally involve reserved or non-printing characters, improbable character sequences or reserved
20 words. Various types and numbers of arguments may be associated with a token. An argument for a military token might be a military rank that is represented by a number. A token and associated arguments are termed an object.

25 It is convenient to use objects for purposes beyond causing dynamic grouping in a selective call system. For purposes of understanding the present invention, objects other than those that cause dynamic grouping may be identified variously as secondary or
30 control objects.

The method of this invention comprises the steps of equipping each of the potential message recipients with a wireless receiver operable to receive messages. The receiver is operable to recognize objects
35 received with an informational portion of a message and

- 5 -

to determine whether the receiver satisfies the objects according to processing rules in a control memory.

Multiple objects may be sent with the informational portion of the message and processing results of individual objects may be combined by Boolean or other operators for greater flexibility of grouping.

Each receiver is operable to store reference data for objects it expects to receive. An example of reference data is a latitude and longitude location that is used to determine presence or absence within a polygon or circle object. The reference data is generally representative of and determined by the owner or user of the selective call receiver.

With the present invention, the message sender predetermines the types or categories of objects, defines the token, argument format and data types, and defines the processing rules for each object. Object, tokens, rules, argument formats and data types are thereafter used and recognized at both the source and destination of the message.

At the time of message transmission, the message sender adds or causes the addition of one or more objects to the message. As an example, the message sender might use a computer mouse to select a circle drawing icon for drawing a circle on a computer map. Selection of the circle icon causes the computer to append a circle token to the text message. The message sender then draws the circle expressed as a center having latitude and longitude, and radius on the computer map. Completion of the circle drawing causes the latitude and longitude and the radius to be attached to the circle token as arguments. The object is transmitted as part of or along with textual information as a message through wireless communications channels of conventional means.

The method continues with each receiver

- 6 -

receiving all transmitted messages and using objects to determine whether the message is intended for that receiver. Receivers that find stored reference data that does not fit arguments of an object or objects received with the message discard the message. When the receiver finds that stored reference data satisfies the arguments of the received object or objects, the receiver takes additional steps. As is appropriate for the application, the additional steps may include displaying of the informational portion of the message, activation of an alarm or other operations.

The method may continue still further if secondary objects effect, direct, or steer other functions such as message decryption, message forwarding, and control operations.

In one case of secondary objects, the invention provides a method of operating a wireless system comprising the steps the receiver identifying an additional object received with the message where the object is indicative of message urgency or priority, storing a value indicative of message urgency or priority for the received message in memory, and using the value indicative of message urgency or priority to control the alarm characteristics indicating message urgency or priority to the user of the receiver by audible, visual, or other means.

In another case of secondary objects, the invention provides a method of operating a wireless system comprising the steps of the receiver identifying an additional object received with the message indicative of when the message will become obsolete at a future time, storing a value representative of time indicative of when the message will become obsolete at a future time, and detecting when the value representative of time till message expiration indicates the message is

- 7 -

obsolete, and deleting the obsolete message from message memory in the receiver.

5 In another case of secondary objects, the invention provides a method of operating a wireless system comprising the steps of the receiver identifying an additional object received with a message directive of forwarding all or part of the message or control portions thereof to external devices or systems or alternatively first translating the message format or protocol and then
10 forwarding the message to other external devices or systems. External devices includes printers, electronic signage, and other apparatus. External systems includes computer data networks, current carrier transmission systems, other wireless communications systems such as
15 another paging system, the short messaging channel of a cellular telephone system, RF activated aids used by deaf and hard or hearing people, and other.

The invention provides the receiver receiving confirmation or status information from external devices
20 or systems as a result of message forwarding, or alternately the further steps of first translating the received confirmation or status information format and then displaying the confirmation or status information on the receivers display. This arrangement allows the
25 receiver to display printer-out-of-paper status or report activation of other aids used by deaf and hard or hearing people that may be coupled by means of an in-home radio-frequency network.

The invention also provides a method of
30 operating a wireless communications system as above but where each receiver is first responsive to a common base address where the object or objects that qualify message retention and further receiver action may be considered a sub-address. In this manner the wireless
35 communications system may serve both clients with

- 8 -

conventional selective call needs and those using the present invention.

5 The invention further provides various methods for programming the reference data into each receiver for each object. The process generally comprises the steps of selecting or generating new reference data indicative of the receiver or owner or user of the receiver, communicating the new reference data to the receiver by receiver keys or switches, a serial port, wireless
10 over-the air and other methods known to those skilled in the art, and storing the reference data generally in non-volatile memory by and for access by the microprocessor of the receiver.

15 In certain applications, the owner or user of the receiver may perform the task of programming reference data as with the receiver keyboard or by calling a service provider that programs the receiver by wireless means. In other applications, a third party or the message sender may perform the programming operation
20 as in the case where the user of a receiver is commissioned with a new professional function or rank or new jurisdictional responsibilities.

The invention also provides various methods for re-programming the reference data stored in each receiver
25 for each category of group identifying description. Reference data may need to be changed from time to time to reflect changes such as the geographic location of the receiver, or the professional advancement of the rank of the owner or user of the receiver. Again, new reference
30 data may be input to the receiver by receiver keys or switches, a serial port, wireless over-the air and other methods known to those skilled in the art.

In one embodiment programming and reprogramming of reference data occurs as a result or is directed by an
35 object as might useful in wireless over-the-air

- 9 -

approaches. The arguments of the object may be the reference data.

In another embodiment, the reference data may be continuously variable. In this case, the process
5 generally comprises communicating the variable reference data from a source of variable reference data to the receiver by serial or other communications channel, where the reference data is provided continuously or upon command of the microprocessor in the receiver, and the
10 receiver determines if the variable reference data satisfies the arguments of the object received as part of a message. A GPS receiver is one example of a source of variable reference data.

The invention also provides a receiver unit for
15 use in a wireless communications system operable to direct messages to specific groups of receivers within a larger group of receivers within the service area of the system. The receiver unit comprises a wireless receiver, a rules driven decoding means coupled to the wireless
20 receiver for recognizing an object, a memory means for storing reference data characteristic of the receiver or owner or user of the receiver, a rules guided computational means for determining whether the reference data satisfies the arguments of objects received with a
25 message, and when satisfaction of the arguments occurs other responsive means responsive to the computational means.

As a further refinement, the rules guided computation means may recognize and combine the results
30 of individual tests of reference data against objects by Boolean or other operators incorporated into the message.

The invention provides as one further responsive means of the receiver a display for presenting the informational portion of the message.

35 The invention provides as one further

- 10 -

responsive means of the receiver a generator for audio, visual or other annunciation means.

5 The invention provides as a still further responsive means of the receiver a computational means to recognize secondary objects that effect, direct, or steer all or part of the message including message decryption, selection of a path for forwarding all or part of the message through an input/output interface of the receiver.

10 Another responsive means of the receiver comprising steps a computational means to recognize a secondary object received with or as part of the message indicative of message urgency or priority, a procedure for storing a value indicative of message urgency or
15 priority responsive to the object along with the message, a generator responsive to the value indicative of message urgency or priority and providing various amplitude, frequency, pattern and other characteristics indicative of message urgency or priority, and audible or other
20 annunciator means responsive to the various amplitude, frequency, pattern or other generator drive characteristics.

Another responsive means of the receiver comprising the steps a computational means to recognize
25 a secondary object received with or as part of the message indicative of when a message becomes obsolete, a means or procedure of storing a value indicative of when the message becomes obsolete along with the message, an
computative means of operating on or otherwise detecting
30 when the value indicative of when the message becomes obsolete for determining when obsolescence has occurred, and means for deleting an obsolete message and terminating receiver activities such as alarms associated with the message.

35 The invention provides as a still further

- 11 -

responsive means of the receiver comprising the steps a
computational means of recognizing a secondary object
received with or as part of the message directive of
forwarding all or part of the message or alternately
5 first reformatting and then forwarding all or part of the
message, forwarding by means of one or more
communications ports of the receiver. Communications
ports may include serial, IrDA (infrared light), RF or
any other interface required by devices such as computers
10 or systems such as current carrier networks.

The invention further provides a receiver that
has communications ports configured to receive data,
status, message confirmation or other information input
from external devices such as a baby monitor and systems
15 such as a security system, a computational means in the
receiver for acting on or alternately first reformatting
and then acting on the information. Acting on the
information may involve displaying, alarming or other
activities appropriate to the type of information
20 received through the communications ports.

In one embodiment, the receiver further
includes a memory for storing one or more previously
recorded messages and a display or annunciation means for
presenting the previously recorded message in response to
25 receipt of an appropriate informational input.

In one embodiment, the receiver further
forwards the informational input or alternately first
reformats the informational input and then forwards the
information input, an output means such as an radio
30 frequency transmitter, a secondary mobile receiver means
having aural, non-aural or other means whereby the
secondary mobile receiver may indicate receipt of
informational input by deaf, hard of hearing or other
people in local proximity to the first receiver as in the
35 case of mowing the lawn.

- 12 -

The invention further provides a receiver that after signal reception and data recovery the step of decoding a base address that is common to all potential message recipients. By this means, receivers such as conventional belt pagers and receivers of the present invention can operate independently on a common wireless selective call system.

The invention further provides a receiver having memory for reference data used for qualifying arguments of objects, programming and reprogramming means for storing reference data in reference data memory, and communications ports for receiving reference data and programming commands. The communications ports include the radio front-end of the receiver, keys or switches on the receiver, and other means known to those skilled in the art.

In another embodiment, the invention provides a receiver having a communications port for receiving external reference data continuously or on demand, and a rules guided computational means for determining whether the reference data satisfies the arguments of objects that uses reference data provided by an external device rather than reference data stored in receiver.

It is a prime object of the invention to provide a new and improved system for effectively disseminating emergency warnings and facilitating emergency response mobilization to affected populations amongst vast numbers of potential warning recipients and responders in the briefest period of time, without deployment of vast new communications infrastructure.

It is an object of the invention to provide a new and improved system for disseminating information to specific groups among a plurality of potential message recipients utilizing existing, low-cost communications media.

- 13 -

It is a further object of the invention that the specified groups of receivers perform additional steps such as activating external sirens, triggering remote devices, and further routing or first translating and then routing information through other physical media in accordance with the media type, protocol requirements and other nature of the required communications.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with the further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings, wherein like reference numerals identify like elements, and wherein:

FIGURE 1 is a simplified block diagram of a one-way, selective call communications system embodying various features of the invention.

FIGURE 2 is a simplified geographic depiction of a coverage area serviced by a selective call communications system, useful in understanding one approach to communicating with receivers located within a selected sub-area located within the broad coverage area.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and, in particular, to Fig. 1, a simplified block diagram of a selective call communications system 10 is illustrated. In accordance with one aspect of the invention, the system 10 is configured to communicate information from a message originator to a specific group of message recipients amongst a larger group of potential message recipients. In the illustrated embodiment, the system is particularly well suited for use by public safety departments,

- 14 -

disaster warning agencies and the like to transmit limited, content specific messages to affected groups of recipients among a larger group of potential recipients. For example, the system can be used by a metropolitan
5 disaster agency to warn particular residents of a community (e.g. those residents living in the flood plain of a river) of an impending situation affecting only those residents (e.g., imminent flooding along the river). Although a signal is broadcast over the entire
10 community and, hence, is potentially receivable by every member of the community, the system 10 functions automatically to direct the message to the affected members without also directing the message to the unaffected members. The system helps ensure that the
15 affected members receive the message and also helps avoid "bothering" the unaffected members with a message that does not concern them. In accordance with a principal aspect of the invention, the system is easily and economically implemented using substantially existing
20 communications media.

In the illustrated embodiment, the system 10 includes a message origination system 12 that originates the message to be communicated to the specified group of potential recipients and includes a computer 14 coupled
25 to the telephone network through a modem 16. The message origination system 12 communicates with a wireless communications system through a wireless network access terminal 20 via a telephone network 18 all of known construction. The wireless network access terminal 20
30 consists of at least one modem 22 and a network gateway 24 typically computer hardware of known construction. The wireless network access terminal 20 forwards messages from the message origination system 12 through a wireless network message distribution network 28 to radio
35 frequency transmitter 30 or to multiple radio frequency

- 15 -

transmitters 30 through 32 as required to reach all potential message recipients. Although an existing telephone network 18 is contemplated, it should be understood that the particular type of system used is not critical to the invention, and that other forms of existing and future communications systems, i.e., analog or digital, wireless personal communications, coaxial, broad-band fiber, optics etc., can be used. Similarly, the wireless communications system could be radio paging, cellular telephone, satellite direct or other wireless network.

It is assumed that specified groups of potential recipients have been previously identified according to some selection criteria. For example, potential recipients can be classified as having (a) a physical location which can be encompassed by a type of geographic form such as a polygon, (b) membership or functional role in an emergency response organization, utility or municipal crew, media outlet, c) a standard industrial classification (SIC) code indicative of heavy construction equipment, personal transport and other resources, or d) some other characteristic.

In any event, each classification of potential message recipients is assigned a token normally represented as a unique reserved non-printing character or improbable character string. Tokens are followed by or encapsulate arguments that more specifically define the token. Arguments include the professional rank within a municipal crew or unit number of a response group. Sub-argument levels are feasible. Objects may also contain an indicator of the length or number of arguments. By adding selection information into the message and thereafter decoding it in each individual selective call receiver 50, the selective call receivers 50 can, on an individual basis, determine whether they

- 16 -

are part of the intended message receiving group. If not, they can ignore the message. If they are, they can respond as is appropriate.

5 An object or objects used to qualify further selective call receiver 50 response may be considered the "address" of a specific group amongst the potential group of message recipients. The particular classification of address objects is not critical to the invention, and the types of classifications herein referenced are for
10 illustrative rather than limiting purposes.

 The computer 14 functions to keep track of the tokens, to automate the assembly of the arguments, and to append the object consisting of tokens and related arguments to the informational portion of a message. The
15 message with the incorporated object "address" is then communicated through the modem 16 and existing telephone network 18 to the wireless communications system access terminal 20. Wireless communications system access terminal 20 includes a modem 22 that receives the message
20 with the incorporated object address and supplies the message with the incorporated address to a message distribution network 28 and ultimately to one or more wireless transmitters 30 & 32 for broadcast as radio frequency signals 40.

25 Radio frequency signals 40 are received by the selective call receivers of all potential message recipients where selective call receiver 50 is representative of all selective call receivers. Selective call receiver 50 uses RF receiver 52 and data
30 recover 54 circuitry of known form to first convert radio frequency signals 40 to a baseband digital information thus reconstituting the original message. The demodulated message is passed to a microprocessor 60 that uses instructions in control memory 62 to determine
35 whether a received message is intended for the receiver.

- 17 -

The method continues with steps the microprocessor 60 parsing the digital string comprising the message to identify tokens and related arguments, testing reference information stored in reference data memory 66 against the arguments of received objects using testing rules appropriate to the type of object where the rules are coded in control memory 62. When the reference data does not satisfy the arguments of the addressing object or objects, the microprocessor discards the received message. When the reference data satisfies object arguments, the microprocessor 60 stores the message in message memory 64 and performs other steps appropriate to the specific application such as displaying the textual portion of the message on message display 70 or activating an audible alarm 72.

In another embodiment, the selective call receiver 50 receives the radio frequency signals 40 through RF receiver 52 and data recover 54 circuitry, and then decodes a base selective call address with base address decoder 56. A unique address is assigned to each client by radio paging service providers serving many clients with different applications. In this application, all potential message recipients are treated as a single client. With a common base address, the selective call receivers of all potential message recipients receive all messages as the first step in qualifying message reception. Following rules in control memory 62, the microprocessor 60 parses the digital string comprising the message to identify an object. The microprocessor 60 tests reference information stored in reference data memory 66 against the arguments of objects. When the reference data does not satisfy object arguments, the microprocessor 60 discards the received message. When the reference data satisfies object arguments, the microprocessor 60 stores the message in

- 18 -

message memory 64 and performs other steps appropriate to the specific application. In this embodiment, the object provides a "sub-addressing" function but otherwise provides the same grouping function as when considered an
5 "address".

The invention further provides various methods for programming the reference data into each selective call receiver 50 for each object. Referring to FIGURE 1, the process generally comprises the steps of selecting or
10 generating new reference data indicative of the receiver or owner or user of the receiver, communicating the new reference data to the receiver by keys 76 or an input / output interface 74 or wireless over-the air using the RF receiver 52 and data recover 54 signal path or other
15 methods known to those skilled in the art, and storing the reference data generally in non-volatile memory represented by reference data memory 68 by and for access by microprocessor 50 of selective call receiver 50.

In certain applications, the owner or user of
20 the selective call receiver 50 may perform the task of programming reference data as with keys 76 or by calling a service provider that programs the selective call receiver 50 by wireless means. In other applications, a third party or the message sender may perform the
25 programming operation as in the case where the user of a receiver is commissioned with a new professional function or rank or new jurisdictional responsibilities.

The invention also provides various methods for re-programming the reference data stored in each receiver
30 for each category of group identifying description. Reference data may need to be changed from time to time to reflect changes such as the geographic location of the receiver, or the professional advancement of the rank of the owner or user of the receiver. Again, new reference
35 data may be input to the receiver by keys 76 or an input

- 19 -

/ output interface 74 or by wireless over-the air using the RF receiver 52 and data recover 54 signal path of selective call receiver 50 or by other methods known to those skilled in the art.

5 In one embodiment, programming and reprogramming of reference data occurs as a result or is directed by an object. For wireless over-the-air approaches the steps may further comprise including the individual serial number or the present location of
10 selective call receiver 50 as one argument of the object and including new reference data as another argument of the object, the microprocessor 60 correlating the serial number or present location of selective call receiver 50 to arguments of the object, and when successfully
15 correlated programming or reprogramming reference data argument into reference data memory 66.

Still another feature that can be implemented is a roving version of selective call receiver 50 capable of receiving localized messages while moving within or
20 through an affected space or area. Such a receiver can be equipped, for example, to communicate with a global positioning system (GPS) receiver that monitors the geographical position of selective call receiver 50 and supplies positioning information that can be used by
25 selective call receiver 50 to determine whether the receiver is within the geographic area specified by the message originator, and broadcast by transmitters 30 and 32. A communications channel such as input / output interface 74 would be used for communications between
30 selective call receiver 50 and the GPS receiver. In any case, location data provided by the GPS receiver would be used by selective call receiver 50 in place of the fixed location reference data in reference data memory 66. If the current location as provided by the GPS receiver
35 falls within the specified geographic area of a message,

- 20 -

selective call receiver 50 displays the message. If it does not, the message is ignored.

In one embodiment, the invention provides that an object and associated arguments are qualified using
5 rules in control memory 64 against reference data in reference data memory 66, and that qualification causes message display via message display 70, alarm activation via audible alarm 72 or other further activity.

One important mode of operation is in using a
10 selective call system 10 of FIGURE 1 to contact receivers within a defined geographic sub-area of the overall service area. One way to achieve this is depicted in FIGURE 2. In this method and system, the agency generating or originating the message uses a polygon
15 object 110 to represent polygon 100. As an example of the digital representation of polygon 100, the polygon token 115 of polygon object 110 is followed by a count 120 of the polygon vertices and 5 latitude / longitude coordinate point arguments 121, 122, 123, 124, and 125
20 that correspond to the five vertices 101, 102, 103, 104, and 105 of polygon 100. In this example, polygon token 120 is represented by a non-printing ASCII character <DC1> having a Hex 11.

It is assumed that the message is intended for
25 all selective call receivers with polygon 100 bounded by geographic coordinate points 101, 102, 103, 103, 104 and 105. The geographic coordinates are selected to correspond with the actual physical location of the area for which the message is intended. The points are
30 preferably generated using a geographic map generated by a computer as the computer 14 of FIGURE 1 and displayed on a video monitor or screen within the agency generating the message. By highlighting an individual area on a computer based mapping system, individual coordinates can
35 be established for any point. By selecting five grid

- 21 -

coordinates, a polygon area defining the desired contact area can be established. By selecting and causing the polygon token and grid coordinate arguments to be included with a message and using the selective call system 10 to broadcast the message, individual selective call receivers 50 can determine whether they are contained within the defined polygon area and act accordingly.

Algorithms for determining presence or absence in the defined polygon area are of known construction. Individual selective call receivers 50 use a reference geographic coordinate point stored in reference data memory 66 as shown in FIGURE 1 in the algorithm. The reference geographic coordinate point and the arguments 121, 122, 123, 124, and 125 of polygon object 110 have a coordinate system in common.

The invention provides for any geographic object shape and related algorithm that determines presence or absence in areas of those shapes as a means of dynamically grouping message recipients amongst a larger number of potential message recipients.

The invention further provides that a message may contain multiple objects for dynamically grouping message recipients amongst a larger group of potential message recipients, that each object and associated arguments are qualified by pre-determine codified rules or algorithms against reference data characteristic of the user or owner of the selective call receiver, that the results of qualifying multiple objects may be combined by Boolean or other operators, and that qualification may cause message display via message display 70, alarm activation via audible alarm 72 or other activity.

An example of this further provision is the following message string:

- 22 -

<DC1> lat/lon1, lat/lon2, lat/lon3,
lat/lon4, lat/lon5 <DC2> ws, vf <__>
& Funnel cloud reported in county to
west. Activate watch procedures.

5 Where DC1 is the polygon token and lat/lon1 through
lat/lon 5 are arguments of the polygon token, where DC2
is a function token and ws and vf are weather spotter and
volunteer firefighter arguments respectively, and where
10 <__> is the Boolean object and & is a Boolean "AND"
argument.

 Accordingly, selective call receivers 50 of
weather spotters and volunteer firefighters within the
defined polygon activate audible alarms and display the
informational message, "Funnel cloud reported"

15 As a further refinement, system 10 of FIGURE 1
can be operated with secondary objects that cause all or
part of textual or control information of a qualified
received message to be routed to auxiliary devices or
networks where the arguments of the secondary object may
20 define the routing or otherwise guide the communications
process. The steps of the further refinement may
comprise for example, the microprocessor 60 parsing,
identifying and qualifying one or more "address" objects
causing the selective call receiver 50 to retain the
25 received message and continue operation on the message,
specifically microprocessor 60 further parsing,
identifying, and qualifying a secondary object causing
subsequent operations.

 One secondary object may contain arguments
30 representing message urgency or priority. In this
manner, microprocessor 60 may generate alarms with
various amplitude, pattern, and frequency characteristics
indicative of message urgency or priority.

 One secondary object may control the amplitude,
35 duration and pattern of audio alarms and visual

- 23 -

annunciators so that message urgency is conveyed audibly, visually or tactically to message recipients.

One secondary object may contain arguments representing the time at which a message becomes
5 obsolete. The steps of this further process comprising microprocessor 60 parsing, identifying and evaluating address objects, when address objects are satisfied retaining the message and the microprocessor 60 taking
10 further steps. The further steps comprise the microprocessor 60 parsing the message string and identifying a secondary object indicative of message expiration, storing the argument of the expire object or a value representative of that argument as a measure of
15 when the message will become obsolete at a future time along with the message in message memory 64, periodically testing or otherwise detecting when the argument or representative value indicates expiration, and deleting the message from message memory 64 and terminating alarms and other activities associated with the message.

20 One secondary object may cause or direct all or part of the textual or control portion of the message through the input/output interface 74 of FIGURE 1 through transport media to one or more external devices or systems such as a highway billboard, a generator that
25 scrolls a message across the bottom of a TV screen, a server of a computer network that can post information via an corporate network, a text to speech synthesizer, and other communications means of know construction. As used herein, transport medium is intended to include any
30 medium through which electrical or optical signals or energy can be transported from one location to another and includes, for example, power distribution networks and wiring, telephone or data communication networks, wireless links, optical fibers and the like. The
35 information forwarding process may involve first

- 24 -

reformatting the information or converting the protocol for compatibility of each transport media.

5 The textual or control portion of the message forwarded through the input/output interface 74 is useful for turning off utility valves, triggering the vibrator of an on-site pager of deaf individuals who may be performing chores in the yard, or triggering a status response.

10 It should be obvious that a triggering operation could be used to return status or other information to the message origination system 12 of FIGURE 1 where the system 10 is made bi-directional. A bi-directional system could provide emergency managers confirmation of message reception at and readiness by critical infrastructure such as hospitals.

15 Still another advantageous feature that can be incorporated into the selective call system described herein is the ability to use single or multiple message launch sites only one of which is fully depicted in FIGURE 1 as message origination system 12. In other words, a message that is to be transmitted to one or more receivers as typified by selective call receiver 50 can originate at more than one site and can be transmitted over the service area via one or more transmitters as represented by radio frequency transmitters #1 and #n, 30 and 32 respectively. Other launch sites can be provided with similar or identical software to provide redundancy and mutual aid capabilities with minimal additional cost.

25 Still further refinements can be made by the steps comprising including a message identifying number in all messages, and in a subsequent message microprocessor 60 parsing and identifying a secondary object having as an argument a message identifying number. When the microprocessor 60 of selective call receiver 50 recognizes a object indicative of canceling

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- 25 -

a previous message, microprocessor 60 checks for the presence of a stored message having the message identifying number and if present deletes the stored message having a message identifying number matching the argument message identifying number of the object causing message deletion.

Still another feature that can be implemented is the capability of linking with other local premise based RF coupled devices such as baby monitors, telephone monitors and doorbell ring detectors. The feature is particularly useful to the hearing impaired who cannot respond to ordinary sound-based signals. Such devices can be linked to a transmitter that generates a secondary signal receiver channel coupled to the selective call receiver 50 of FIGURE 1. The selective call receiver 50 can be made to recognize the signals of other local premise based RF couple devices and echo the alert of these devices via the message display 70, audible alarm 72, or other means of selective call receiver 50. By coupling a selective call receiver 50 through an input / output interface 74 to a low power transmitter or on-site selective call system, a warning repeater is formed by which an on-site pager having a vibrating alarm indicator to aid persons who cannot hear sound-based warnings, signals or messages.

Although the invention has been shown and described in its preferred form using a wireless communications system such as a paging system, it will be appreciated that the invention is not limited in its broader aspects to selective call systems or even to wireless communications systems. For example, the invention can also be used in connection with alternative forms of communication and message delivery such as wireless telephones, the Internet, hardwired computer systems, television or other broadcast receivers or

- 26 -

combinations of such devices.

While a particular embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications can be made without departing from the invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

- 27 -

CLAIMS:

1. A method of operating a wireless system so as to communicate specific messages to specific groups among a plurality of potential message recipients within an arbitrarily selected specified geographic area, comprising the steps of:

identifying specific groups among the plurality of potential message recipients;

assigning to each of the identified specific groups a group specific address;

equipping each of the potential message recipients with a wireless receiver responsive to the group specific address of the specific group to which the potential message recipient belongs,

generating and transmitting to each of the receivers a message containing an informational portion and an address portion, the address portion containing the group specific address,

determining at each of the receivers presence or absence within the specified group specific address, and

displaying the informational portion of the message at the receivers determined to be within the specified group specific address.

2. A method of operating a pager-based communications system according to claim 1 further comprising the steps of:

generating and transmitting a message additionally having a control instruction portion;

transmitting the message via a wireless signal;

receiving the transmitted message on a receiving unit operable to respond to messages containing the group specific address;

decoding the control instruction portion of the message and, in response to receipt of an appropriate

- 28 -

15 decoded control instruction, thereafter transferring the informational portion of the message to a different wireless paging system for distribution over the different paging system.

20 3. A method according to claim 1 wherein said message further comprises signals identifying said arbitrarily selected geographic area and said receiver receives said signals and displays said informational portion of the message only if said receiver is determined to be within the arbitrarily selected geographic area.

5 4. A receiver unit for use in a pager-based communications system operable to direct messages to specific groups of pagers within a larger group of receivers within the service area of the system comprising:

a wireless receiver responsive to a base address;

10 a decoder coupled to the wireless receiver for recognizing a group-identifying indicator indicative of inclusion within the specific group;

an audible alarm annunciator responsive to the wireless receiver and the decoder for sounding an audible alarm in the event of receipt of an alarm message directed to the receiver unit; and

15 control circuitry for silencing the audible alarm after passage of a predetermined time period following receipt of the alarm message.

5 5. A receiver unit as defined in claim 4 wherein the control circuitry is further operable to reduce the audio level of the audible alarm in response to appropriate control signals received from the wireless receiver.

6. A receiver unit for use in a pager-based communications system operable to direct messages to

- 29 -

specific groups of pagers within a larger group of receivers within the service area of the system comprising:

5 a wireless receiver responsive to a base address;

a decoder coupled to the wireless receiver for recognizing a group-identifying indicator indicative of inclusion within the specific group;

10 circuitry coupled to the decoder and the wireless receiver for recognizing an informational portion of a message directed to the specific group of receivers, and

15 additional circuitry responsive to an informational input received independently of the message directed to the specific group of receivers;

the informational input comprises a signal indicative of the geographic location of the receiver unit.

20 7. A receiver unit as defined in claim 6 wherein the informational input is obtained from a global positioning system receiver.

8. A receiver unit as defined in claim 6 wherein the informational input is derived from a sensor located in the vicinity of the receiver unit.

9. A receiver unit as defined in claim 8 wherein the sensor is selected from the group consisting of baby monitors, telephone monitors and door bell ring detectors.

10. A receiver unit as defined in claim 6 further comprising a memory for storing one or more pre-established messages and a display for displaying the pre-established message in response to receipt of an appropriate informational input.

5 11. A receiver unit as defined in claim 6 further comprising a non-aural based indicator for

- 30 -

indicating receipt of an informational input.

12. A receiver unit as defined in claim 6 further comprising an alternate source of operating energy.

13. A receiver unit as defined in claim 12 wherein the alternate source comprises a battery-operated power supply.

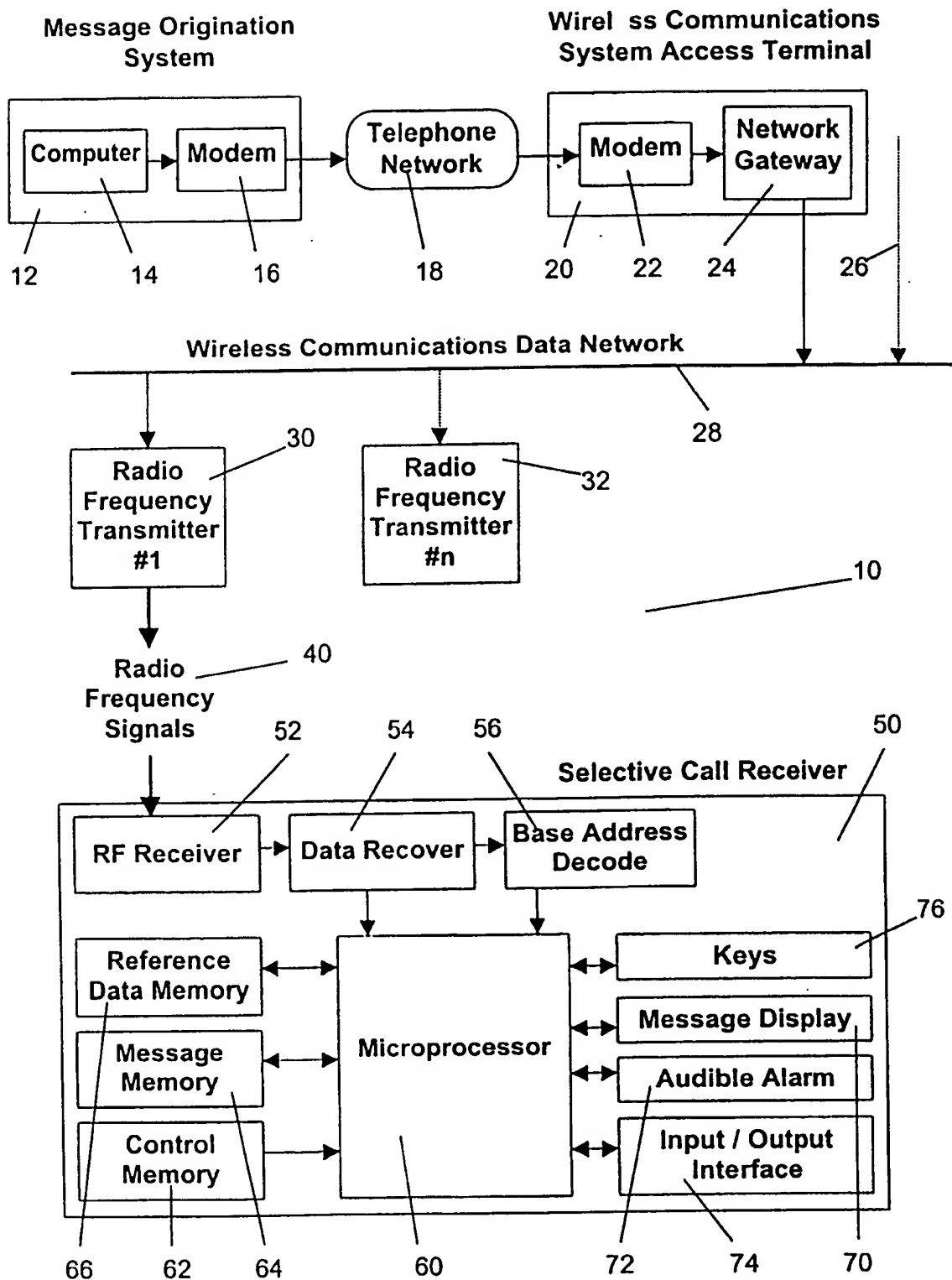
14. A receiver unit as defined in claim 13 further comprising a light source actuated upon actuation of the alternate source.

15. A method of operating a wireless communications system comprising the steps of:

generating a message having a base address portion, a control instruction portion and an informational portion;

transmitting the message via a wireless signal;
receiving the transmitted message on a receiving unit operable to respond to and record messages containing the base address; and

decoding the control instruction portion of the message and, in response to receipt of an appropriate decoded control instruction, canceling the informational portion of a previously received message.

**FIGURE 1 One Way Selective Call System**

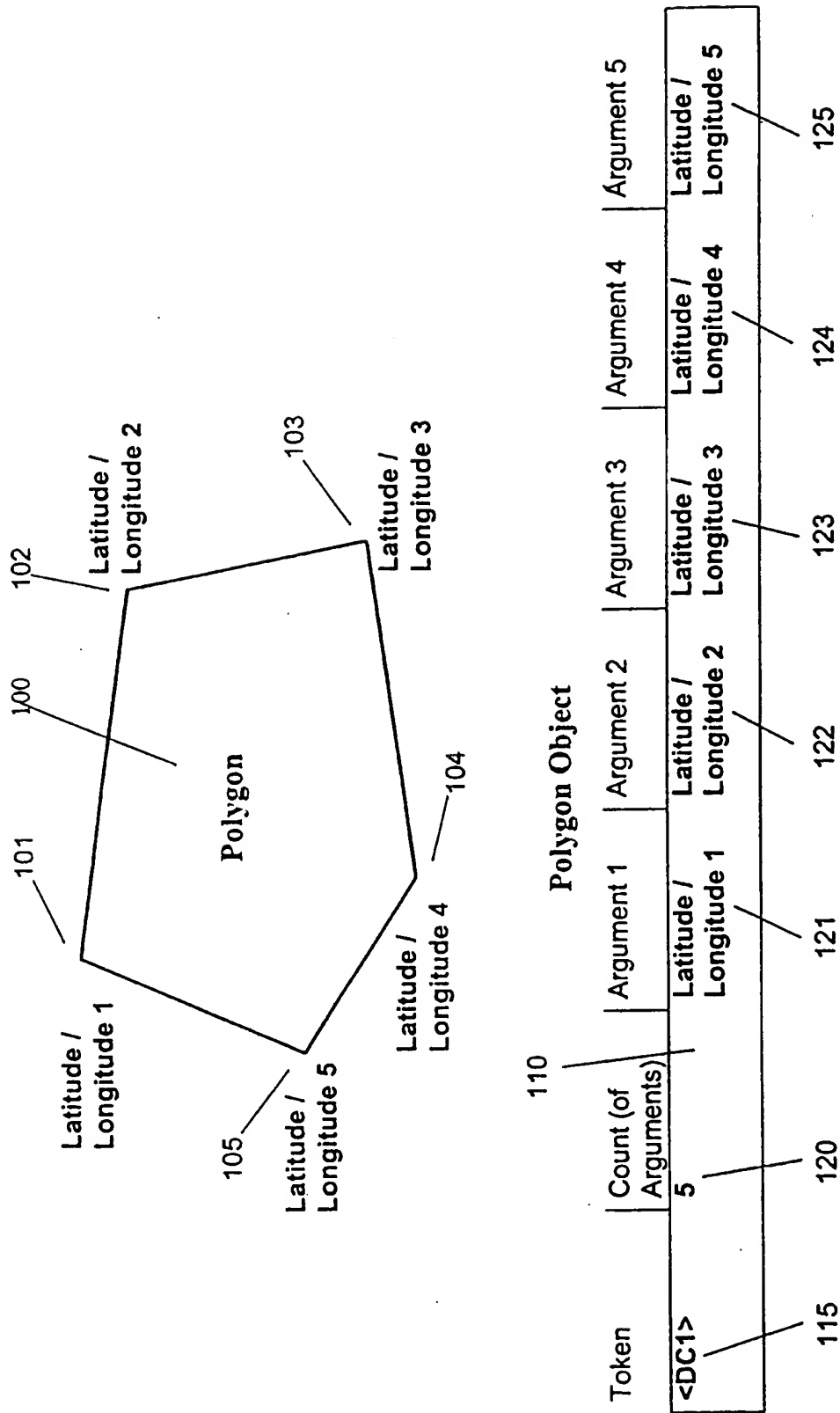
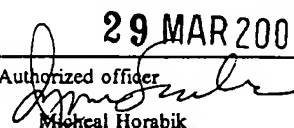


FIGURE 2 Polygon and Polygon Object

INTERNATIONAL SEARCH REPORT

 International application No.
 PCT/US00/41962

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : G08B 5/22 US CL : 340/825.47;455/70 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : Please See Extra Sheet. Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,077,830 A (MALLIA) 31 December 1991, col. 2, lines 26-59;	1,3,8-9
----	col 4, lines 36-68 and col. 5, lines 1-18.	-----
Y		2,4-7,10-15
Y	US 5,635,914 A (PETREYE et al.) 03 June 1997, Figs. 1-2.	2, 5-6, 11-15
Y	US 4,891,638 A (DAVIS) 02 January 1990, Figs. 1-3.	4, 6-7, 10
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:	*T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A document defining the general state of the art which is not considered to be of particular relevance	*X	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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*P document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search	Date of mailing of the international search report	
23 FEBRUARY 2001	29 MAR 2001	
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer  Michael Horabik	
Facsimile No. (703) 305-3988	Telephone No. (703) 305-4704	

INTERNATIONAL SEARCH REPORT

International application No.
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B. FIELDS SEARCHED

Minimum documentation searched

Classification System: U.S.

340/825.47,825.45,825.40,825.49,825.52,825.52,565,541,573;455/58,70;158/34,158